

**Local Jobs and Income
from Mineral Exploration**
A Case Study of the Pebble Exploration Project

By
Bob Loeffler and Jennifer Schmidt
Contact: rloeffle@alaska.edu • jischmidt0@gmail.com
Institute of Social and Economic Research
University of Alaska Anchorage
3211 Providence Drive
Anchorage, Alaska 99508

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Executive Summary

From 2002 until 2013, the Pebble Mineral Exploration Project explored a big deposit of mostly copper, but also gold and molybdenum, in the Bristol Bay region of Southwest Alaska, about 17 miles northwest of Iliamna (Figure S-2). That exploration stopped in 2013, when a major project partner withdrew. But before that, developers spent millions of dollars, and in the last years of exploration annually employed more than a hundred residents of Bristol Bay communities.

This paper describes jobs and income the residents of 18 communities—in the Lake and Peninsula Borough, the Bristol Bay Borough, and the Dillingham census area—got from 2009 through 2012, the last full year of exploration. Most residents of these communities are Alaska Native, and the communities are small—most with populations considerably smaller than 500—except for Dillingham, where nearly 2,500 people live (Table S-1).

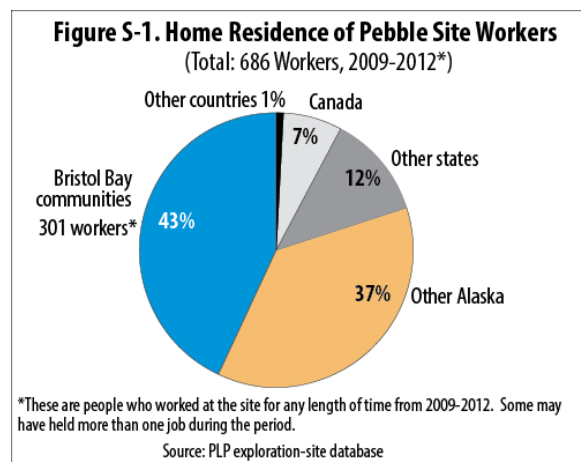
How local communities can capture more economic benefits from rural resource projects is an important question in Alaska, and the Pebble exploration project offers a useful case study. But we want to emphasize that we're neither advocating nor opposing a potential mine at the Pebble site. The proposed mine has been enormously controversial in Alaska and elsewhere, because of its proximity to the world-class Bristol Bay salmon fisheries. We looked only at local jobs and income exploration created, to shed light on the potential for resource development projects to help rural economies. Our analysis is based on data from Pebble Limited Partnership's exploration-site database, augmented with information from contractors. What did we find?

- *About 43% of those who worked at the Pebble exploration site anytime from 2009 through 2012 were from the Bristol Bay area.* That amounted to about 300 local residents who worked at the site some time during the study period (and may have held more than one job over the years). Another 37% of workers were from elsewhere in Alaska, and the remaining 20% were mainly from other states or Canada (Figure S-1).

- *The number of workers from Bristol Bay increased over the study period, and so did employee retention.* In 2009, 111 local residents worked at the Pebble site, increasing to 157 by 2012. More employees also stayed on the job from one year to the next, with retention at just over half from 2009 to 2010, climbing to two-thirds from 2011 to 2012 (Figure S-3).

- *Bristol Bay residents worked at 56 kinds of jobs in the study period, almost all seasonal.*

The most common jobs they held were drill helper, bear guard, and skilled laborer. The average hourly pay was about \$19, and most workers earned on average about \$15,000 a year from those mostly seasonal jobs. About 65% of workers were men and 35% women (Figure S-3).



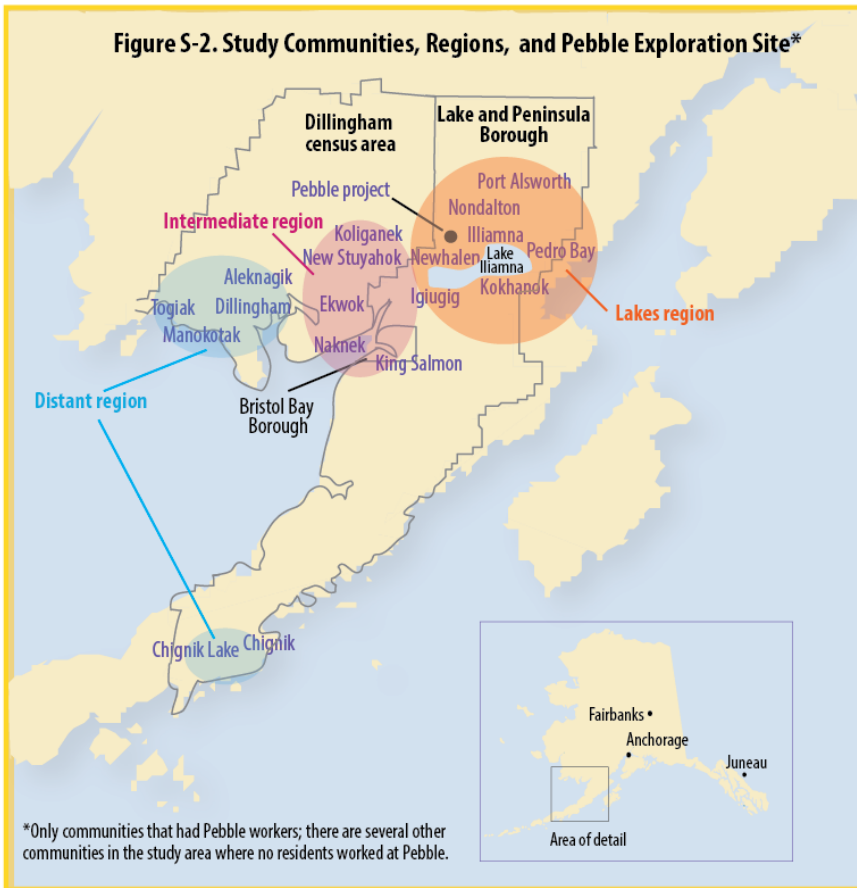
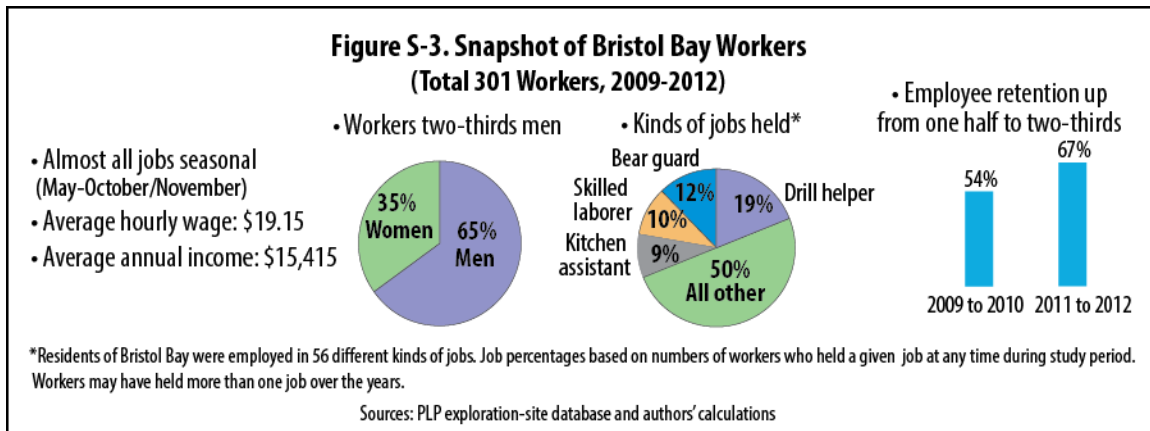
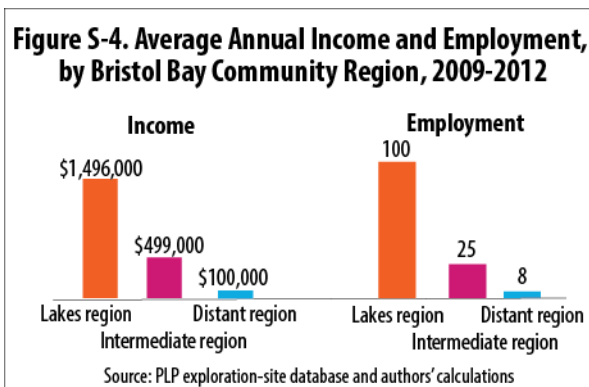


Table S-1. 2010 Populations of Study Regions	
Lakes Region	884
Igiugig	50
Iliamna	109
Kokhanok	170
Newhalen	190
Nondalton	164
Pedro Bay	42
Port Alsworth	159
Intermediate Region	1,900
Ekwok	115
King Salmon	374
Koliganek	209
Naknek	544
New Stuyahok	510
Other Communities	148
Distant Region	4,589
Aleknagik	219
Chignik	91
Chignik Lake	73
Dillingham	2,329
Manokotak	442
Togiak	817
Other communities	618



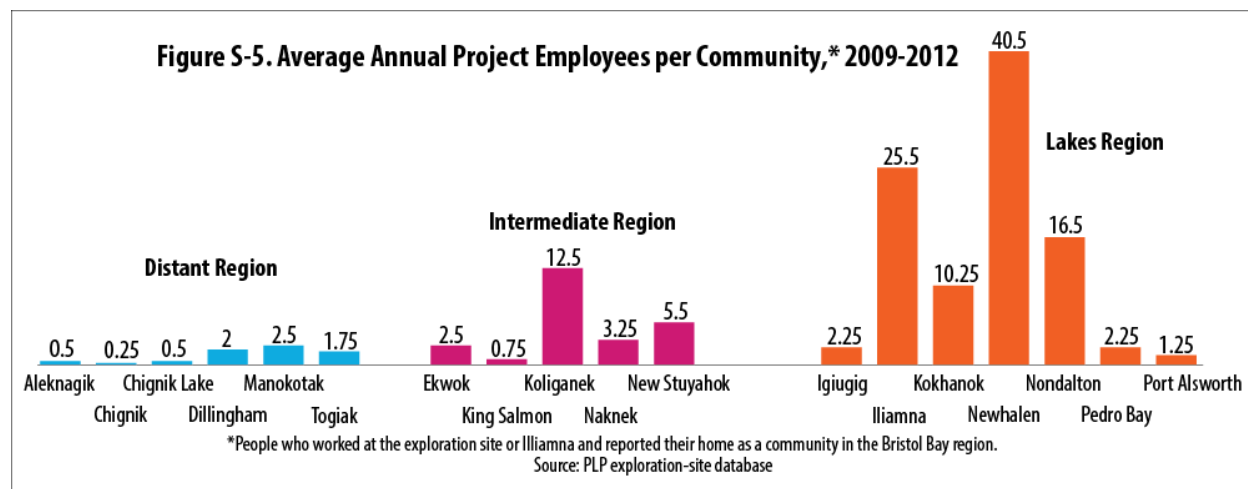
• *Communities closest to the exploration site got several times more jobs and income than those farther away.* We grouped the study communities into three regions, based on their proximity to Pebble. Communities closest to the site are mostly around Lake Iliamna, and on average per year about 100 workers came from what we call the Lakes region. About 25 a year were from the

Intermediate region and 8 from the Distant. On average, workers from the Lakes region collected a total of nearly \$1.5 million a year, compared with \$499,000 for those from the Intermediate region and \$100,000 among those from the Distant region, where communities are more than 100 miles from the Pebble site (Figures S-2 and S-4).

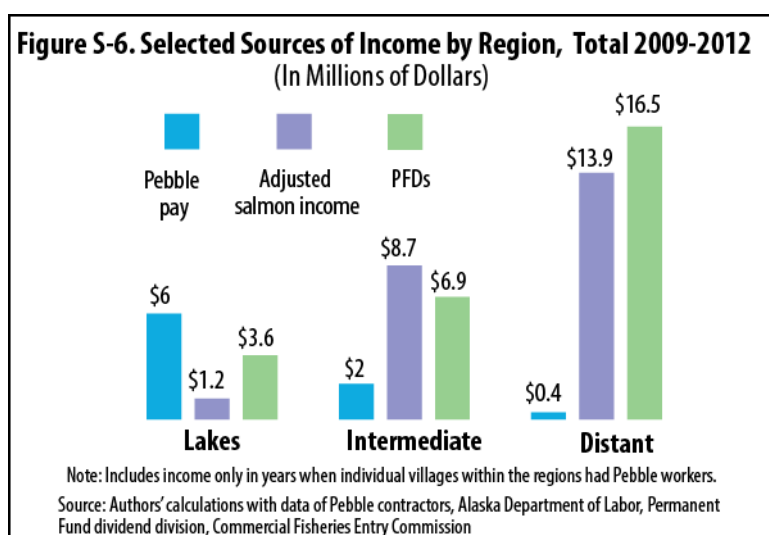


- *In the Lakes region, where communities are very small (Table S-1) exploration employment was a large share of total employment: approximately 14% of the total workforce from Lakes communities worked at the site during the study period. The regions farther from the exploration site, which have larger populations, saw much smaller employment effects: 3% of the total workforce from the Intermediate region and barely above 0% from the Distant region.*

- *Even within individual regions, community employment at Pebble varied significantly. Iliamna, where exploration operations were based, and Newhalen (with road access to Iliamna) had the most employees—an annual average of 40 in Newhalen and about 25 in Iliamna, followed by Nondalton with about 16. Outside the Lakes region, the only community with more than an average of 10 workers a year was Koliganek. But even within the Lakes region, not all communities had a significant number of workers—Port Alsworth and Pedro Bay had fewer workers than some places in the Distant region (Figure S-5).*



- *To get a sense of what Pebble income meant to the region, we compared it with income from two important sources: commercial fishing and Permanent Fund dividends.* The exploration project brought more income into the Lakes region from 2009 through 2012 than did either commercial salmon fishing or Permanent Fund dividends. But the Intermediate and Distant regions have more people, rely more on salmon fishing, and had fewer residents working at Pebble—so Pebble pay in those regions was a much smaller source of income. Income from Pebble in the Lakes region from 2009-2012 was several times more than from salmon fishing and two-thirds more than from Permanent Fund dividends. By contrast, in the Intermediate region Pebble pay was significantly less than from either commercial fishing or PFDs—and in the Distant region Pebble pay was an insignificant amount compared with the other sources.



What can the Pebble case study tell us about the potential for rural development projects to benefit local economies?

- *Residents of Bristol Bay communities and other Alaska places were able to capture a big share of exploration jobs and income.* During the study period, 43% of workers were from Bristol Bay communities and another 37% were from elsewhere in Alaska. A number of things contributed to this high local-hire rate, including Pebble's local hire coordinator; its work with the state government to get training programs and with non-profits to help qualify local residents for jobs; and its contracts with local Native village corporations and other businesses.
- *Jobs and income going to Bristol Bay residents increased significantly between 2009 and 2012.* Partly that's because the developer was spending more for exploration, creating more jobs. But the number of qualified job applicants from the Bristol Bay region also increased over time. Pebble personnel report that by 2010 or 2011, there were more qualified Bristol Bay residents looking for jobs than there were jobs available.
- *Proximity made a difference: even though most project employees from all communities were housed at project headquarters in Iliamna, residents from the villages closest to the project site got more jobs.* From 2009 through 2012, an average of about 100 residents per year from the Lakes region worked at the project site—about 14% of the total workforce from seven small villages. Prospective workers from places farther away may have taken into account how difficult it would be to travel home for time off work.

Section I. Background

In 1986, exploration geologists from Cominco American Exploration found a prospective deposit in the Bristol Bay area of southwest Alaska, near Lake Iliamna. Approximately 25 years later, the exploration had expanded to be a multimillion-dollar activity employing more than 230 people, including more than 150 people from the surrounding, small Alaska Native communities. In September 2013, one of the partners withdrew from the project, and essentially all exploration abruptly ceased.

This article explores the effect of the exploration project on local community employment and income. To examine these effects, it uses information from the company's exploration-site database for the period 2009 through 2012, the last full year of exploration.

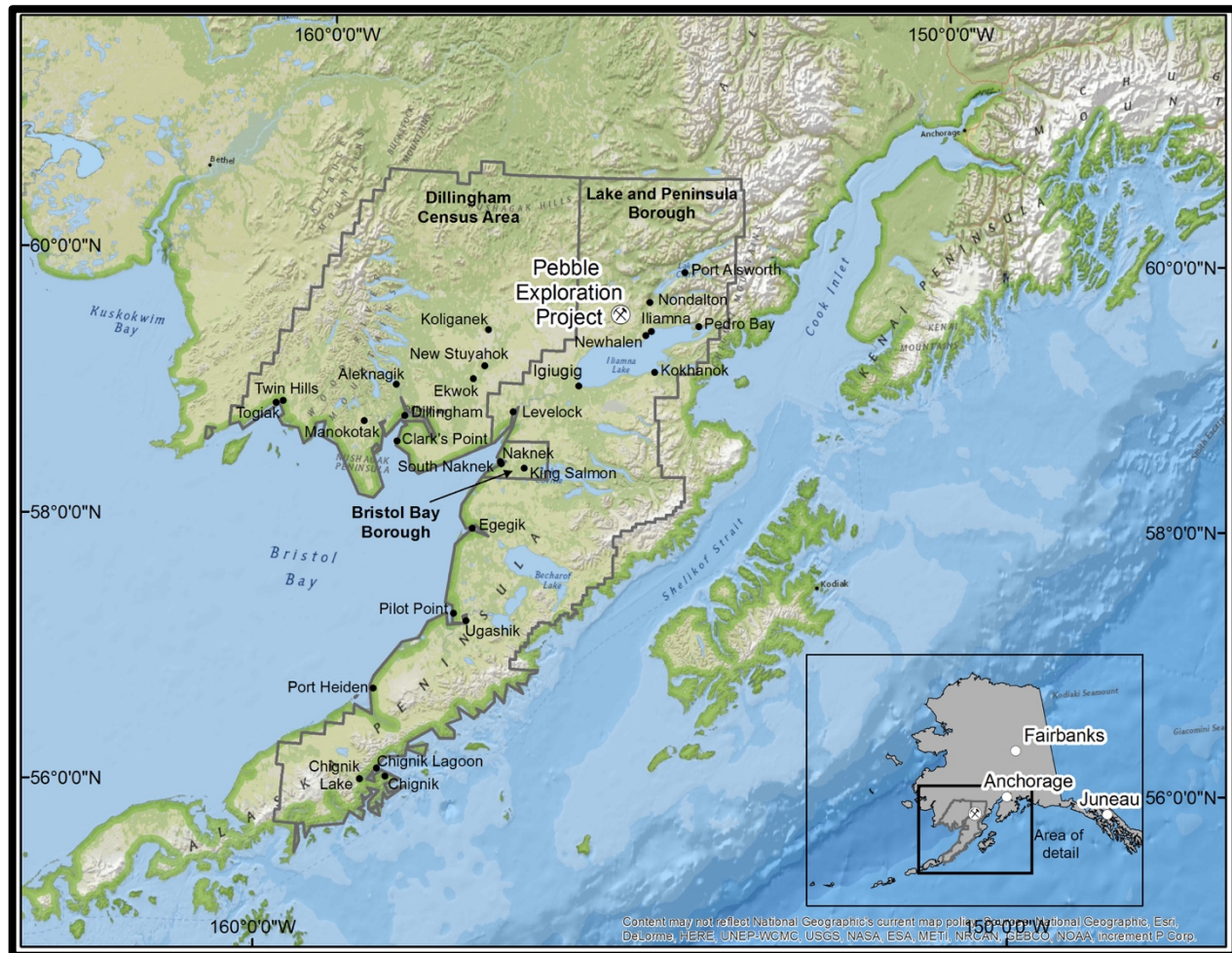
The Pebble project is enormously controversial in Alaska and elsewhere. This analysis takes no position on the controversy. The authors are not making a statement about whether the potential mine would have acceptable or unacceptable effects, or even whether the project could meet permit requirements. Rather, this article examines the income and employment effects on local communities of exploration work, to shed light on the potential for resource development projects in rural Alaska to help local economies. The article does not look at the total economic effects of the exploration—it does not discuss multiplier or secondary economic effects, or changes in social conditions associated with Pebble employment (i.e., changes in health care, travel, subsistence, and other factors). Rather, the article focuses simply on income and jobs local residents got during the last four years of exploration. By understanding these effects, managers or local governments may be able to structure projects to capture more of the positive effects—or avoid negative ones—and to better predict potential employment and income effects on local economies.

A. The Pebble Project

Project History

In 1988, following two years of regional mineral exploration, Cominco American Exploration filed a large series of mining claims on state-owned land in the Bristol Bay area of southwest Alaska. Drilling and other activities began on the property in 1988 and continued through 1993. Activities briefly stopped and then began again in 1997. The exploration activities were based out of Iliamna, 17 miles southeast of the project site. The community has an excellent airport, with two long, paved runways. (See Figure 1.)

Figure 1. Pebble Project Location and the Bristol Bay Region



During this early exploration, the exploration company employed one or two dozen people, a few of whom may have lived in Iliamna or nearby communities. Most of the in-region work was seasonal, with summer drilling followed by analysis and planning outside the region and a much-reduced workforce during winter.

In 2001, Northern Dynasty Minerals, Ltd. purchased an option to buy the project from the original company, which had become Teck Cominco. The next year, 2002, the new company began an extensive exploration program focusing on what proved to be a very large near-surface deposit of mostly copper ore. In 2005, the company found a continuation of the deposit—a deep-underground extension of the surface deposit.

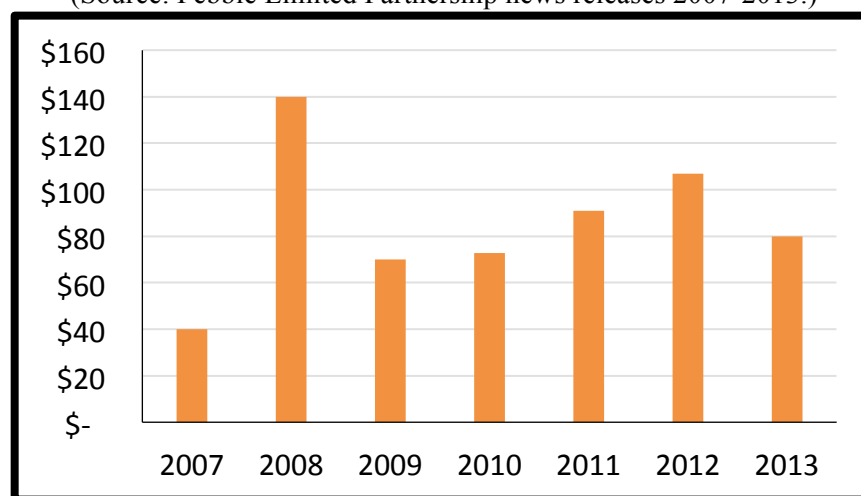
By 2007, Northern Dynasty's financial report said the company held assets worth roughly \$100 million, excluding the value of the mineral property itself. While substantial, this amount fell far short of what was needed to even complete exploration and design for a project of this size. But in July 2007, Northern Dynasty announced it had acquired a partner—Anglo American, PLC, a large international mining company. At the time, Anglo American was one of the five largest mining companies in the world. To acquire a 50% interest in the Pebble project, Anglo agreed to

spend \$1.425 billion dollars on the project: \$450 million more to fund exploratory drilling, baseline data gathering, exploration and permitting, and another \$975 million toward construction (Northern Dynasty Minerals, Ltd. press release, 7/31/07).

With Anglo's participation, exploration and pre-development activity accelerated. Expenditures expanded from the 2007 value of \$40 million to between \$70 and \$140 million annually over the next six years (Figure 2). That spending funded a lot of economic activity for an area with only small, widespread, largely Alaska Native communities. The majority, but not all, of the work was seasonal. On-site work typically began in May and ended in October or November. Most environmental data gathering — wetlands, fisheries, hydrology, etc. — also occurred during the summer, although some continued year-round. However, the major community-related employment was in the summer. At the high point of exploration spending, 2008, the company reported a peak employment at the project site of 232 full- or part-time employees, 130 of whom came from local communities. (Pebble press release, 10/27/08).

Figure 2. Annual Pebble Exploration, Engineering, and Environmental Expenditures
(Amount in Million \$)

(Source: Pebble Limited Partnership news releases 2007-2013.)



The project also developed significant opposition, because of its proximity to the world-class Bristol Bay salmon fisheries. At the same time exploration was expanding, opposition was intensifying.

In September 2013, Anglo American withdrew from the project, after spending \$541 million, and forfeited its potential 50% ownership. The company indicated that in the face of a world-wide contraction in mining funding, it was re-prioritizing its capital expenditures: the long-term nature of the Pebble project made it lower priority, and the company was allocating capital to other projects. The significant opposition from various sources may also have been a factor.

After Anglo's announcement, the few field activities remaining from the summer stopped almost immediately. While summer work for many employees had already finished, others were let go as soon as they could safely disengage. There has been little exploration or environmental activity in the field since then.

From 2007 to the end of field work in 2013, the project developers spent over \$600 million, much of it in the Bristol Bay region. From the time the project started, companies had drilled 1,200 exploration wells and spent over \$150 million on environmental and socioeconomic studies, generated more than 27,000 pages of scientific data and analysis.¹

B. Communities near the Project

Communities near the project share many characteristics but also have many differences. This study investigated the income and employment effects of the exploration project on 18 communities, which we grouped into three regions.

The groups are based on their distance from the exploration site, but also partly on the social interconnections among them. Effects on groups of communities are easier to illustrate than on 18 separate communities. Equally important, many of the community-level government statistics have a wide margin of error. This makes the statistics much less reliable at that level; the sample size is too small to generate reliable statistics. This is especially true of the U.S. Census Bureau's American Community Survey (ACS). Grouping communities into regions, and pooling across years, provides a larger sample size, and increases the reliability of ACS statistics.

The project location, the communities, and the three regions used in this study are shown in Figure 3. The first region, the Lakes region, includes the seven communities closest to the exploration site. They are mostly clustered around Lake Iliamna. The second region, the Intermediate, includes those somewhat further away. The third region, the Distant, includes communities still in the Bristol Bay region, but more than 100 miles from the project.

¹ Northern Dynasty Limited website: <http://www.northerndynastyminerals.com/ndm/Home.asp>; as of 10/16/16.

Figure 3. Study Communities, Regions, and Pebble Exploration Site*



The Lakes Region. The communities around Iliamna Lake and Lake Clark are closest to the exploration project and, not unexpectedly, had the largest number of residents working on the project; all seven communities in this region had workers at the exploration site during the study period. They are recognized locally as a socially interconnected region.² Table 1 shows U.S. census figures for the total 2010 population and the percent Alaska Native population. The entire region had fewer than 900 residents in 2010. Community size varied from 190 in Newhalen to 42 in Pedro Bay. Three-quarters of the region's residents are Alaska Native.³ Most communities

² The social interconnections are reflected in the Lake and Peninsula Borough Charter. The borough, which includes all the study-area communities on the east side of Bristol Bay, groups its 17 communities into three voting districts. The communities of the Lakes region form a single voting district. (Lake and Peninsula Borough Charter, Section 2.02.)

³ The study combined two census categories: American Indian and Alaska Native, and people of two or more races. The latter category is included because, in the author's experience, those who identify as two or more races in rural Alaska are almost always Alaska Native and some other race.

are from two-thirds to more than 90% Alaska Native. The exception is Port Alsworth, where about a quarter of the residents are Alaska Native.

Table 1. Lakes Region: 2010 Population and Percent Alaska Native

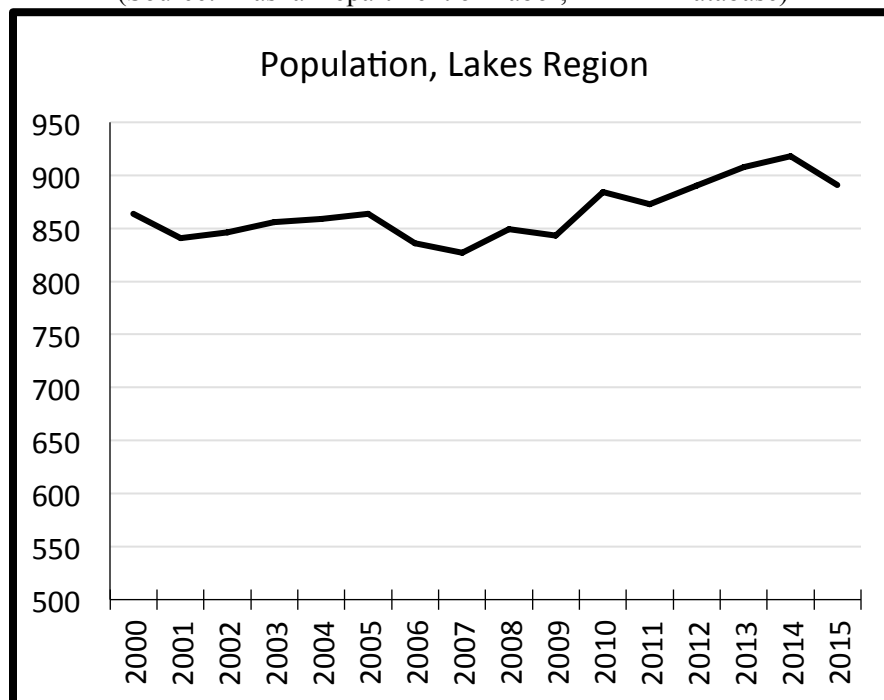
(Source: 2010 U.S. Census)

Lakes Region	Population	% Native
Igiugig CDP	50	72%
Iliamna CDP	109	67%
Kokhanok CDP	170	90%
Newhalen city	190	92%
Nondalton city	164	84%
Pedro Bay CDP	42	71%
Port Alsworth CDP	159	27%
Total	884	73%

The population of the Lakes region has been roughly stable over the last decade and a half. Figure 4 shows the region's population from 2000 to 2015. Combined, the seven villages saw a very slight gain in population, but the regional total masks differences among villages. Newhalen and Port Alsworth both have bigger populations now—especially Port Alsworth, where the number of residents doubled between 2000 and 2015. The remaining five villages all lost population; Nondalton saw its population shrink by a third during that period.

Figure 4. Lakes Region: Population History

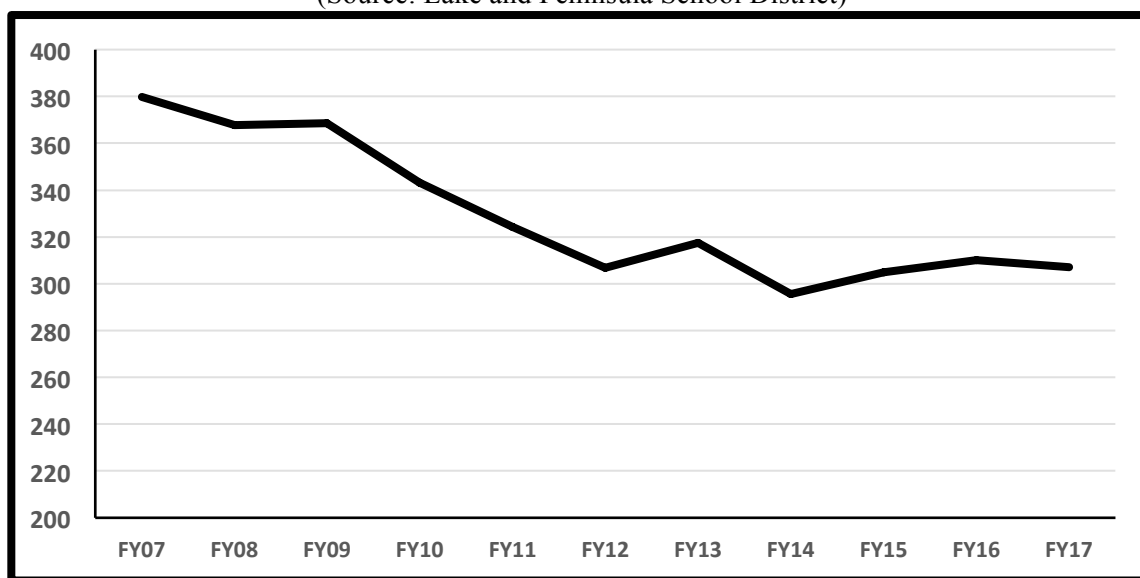
(Source: Alaska Department of Labor, ALARI Database)



Local residents, especially in the Lake and Peninsula Borough communities, frequently voice concern over their communities' shrinking populations. The State of Alaska maintains schools in places that have at least ten children in school. Once a local school closes, population usually drops rapidly. In 2000, the Ivanof Bay school closed and the town was almost deserted within a few years. In 2010, the school in Pedro Bay closed, when it no longer had the required 10 school children. Both villages are in the Lake and Peninsula Borough. Figure 5 shows the historic school population for the Lake and Peninsula School District. The district includes the seven villages of the Lakes region, as well as another 10 villages to the south.

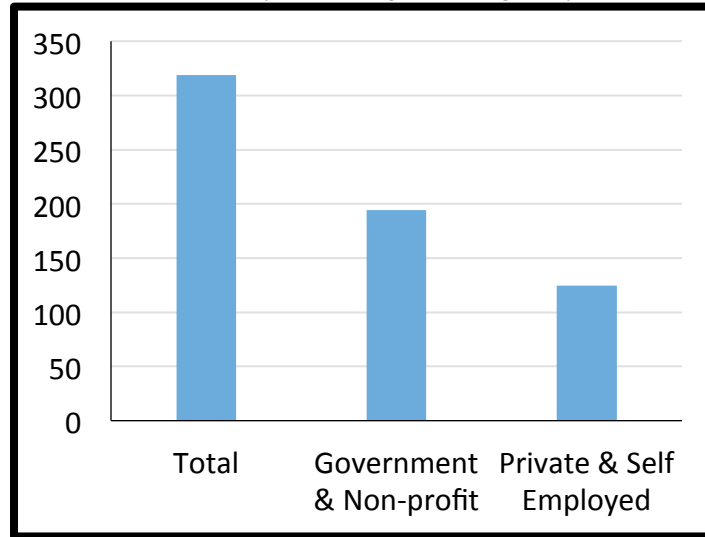
Figure 5. School Enrollment, Lake and Peninsula School District

(Source: Lake and Peninsula School District)



The economy of the region is often characterized as a mixed cash-subsistence economy. The cash sector is dominated by government employment, generally local government (Figure 6). The largest employer is typically the school district. There are significant air taxi operators in Port Alsworth and Iliamna. Also, Lake Clark National Park employees live in Port Alsworth and Nondalton, with possibly a few also in Iliamna. A few other small businesses exist in some communities.

Figure 6. Lakes Region: Annual Employment by Category
 (Source: U.S. Census Bureau: American Community Survey.
 Tables S2408: 2012 Five-year average. Average of years 2008-2012)



The Bristol Bay commercial fishing industry is an important employer and source of income for the region, but the number of permits owned by local residents has decreased over time. Table 2 shows the average annual number of people from each Lakes region community who fished commercial salmon permits in the early 1980s, and the number who fished during our study period, from 2009 through 2012. During that period, local owners fished 39 Bristol Bay salmon permits—less than half the 88 who fished from 1980-1983. That drop is part of a long-term decline in the number of permits fished by local community residents. It does not reflect a decrease solely during the Pebble exploration period, or a drop in the total number of salmon permits fished; instead, it reflects the sale, transfer, or non-use of permits by local residents.

Table 2. Lakes Region: Bristol Bay Commercial Salmon Permits Fished
 (Source: State of Alaska, Commercial Fishing Entry Commission)

Lakes Region	1980-1983	2009-2012
Igiugig	7	2
Iliamna	35	13
Kokhanok	10	9
Newhalen	2	9
NonDalton	25	2
Pedro Bay	6	3
Port Alsworth	4	3
Total	88	39
56% decrease		

In summary, the Lakes region is the closest to the Pebble exploration site. It includes seven relatively small communities with mostly Alaska Native populations. Most of these communities are concerned about population loss; many are worried that they may become too

small to support a school. Much of the population lives a mixed cash-subsistence lifestyle. The cash portion of the economy depends heavily on government jobs, but air-charter operations and commercial fishing also play important roles.

Intermediate Region. The next group of communities is a concentric ring further from the exploration project, and fewer people from these communities worked on the project. Table 3 shows populations of all seven communities in this region; five of those communities had residents who worked at the Pebble exploration site during the study period. The total regional population is 1,900, approximately twice that of the Lakes region. Three of these communities—King Salmon, Naknek, and South Naknek—are largely part of the same community. King Salmon and Naknek are connected by road. South Naknek is just across the river from Naknek. They are near one another, they use the same school and stores, and together they form the Bristol Bay Borough. The other four Intermediate communities—Ekwok, Koliganek, New Stuyahok, and Levelock—are not connected to each other by road. They are significantly downstream from the exploration site. Overall, this group of communities is approximately three-quarters Alaska Native, and most of the non-Native residents live in the Bristol Bay Borough. Places outside the borough have 90% or more Alaska Native residents (Table 3).

Table 3. Intermediate Region: 2010 Population and Percent Alaska Native
(Source: 2010 U.S. Census)

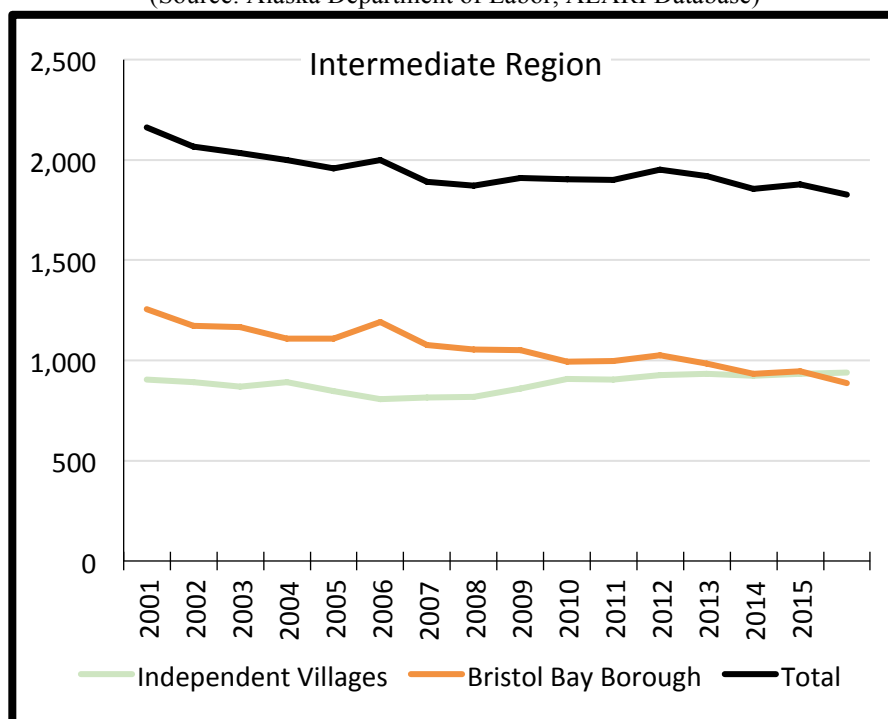
Intermediate Region	Population	% Native
Ekwok city	115	95%
Koliganek CDP	209	97%
New Stuyahok city	510	96%
King Salmon CDP	374	37%
Levelock CDP*	69	90%
Naknek CDP	544	54%
South Naknek CDP*	79	86%
Total	1,900	72%

*Had no workers at Pebble exploration site.

The Intermediate region has been losing population over the past 15 years, though the regional total masks some differences among villages. Overall, the communities in the Bristol Bay Borough have been losing population while the other regional communities have been approximately stable or growing slightly (Figure 7).

Figure 7. Intermediate Region: Population History

(Source: Alaska Department of Labor, ALARI Database)



This region has a similar economy to that of the Lakes region. Government and non-profit jobs make up approximately 60% of the total jobs in the region.⁴ But the Intermediate region relies more on commercial fishing than does the Lakes region. This region has roughly twice the population of the Lakes region, but it had seven times the number of locally-owned active commercial salmon permits during the study period—173, compared with 39. Still, this region too saw a big decline in the number of locally-owned permits since the 1980s (Table 4).

Table 4. Intermediate Region: Bristol Bay Commercial Salmon Permits Fished

(Source: State of Alaska, Commercial Fishing Entry Commission)

Intermediate Region	1980-1983	2009-2012
Ekwok	9	2
Koliganek	22	13
New Stuyahok	33	13
King Salmon	33	29
Levelock*	17	6
Naknek	135	90
South Naknek*	53	20
Total	300	173
		43% decrease

* Had no workers at Pebble exploration site.

⁴ A graph of the ratio of private and self-employed to government jobs would be similar to Figure 6 for the Lakes Region. The source is the same ACS data, and differences between the two regions are close to being within the margin of error.

In summary, the Intermediate region has more people and a stronger commercial fishing focus than does the Lakes region. King Salmon/Naknek/South Naknek is a hub for commercial fishing—though the cash economy is still supported largely by government employment. The communities in this region are farther from the exploration project.

Distant Region. The Distant region includes 14 communities in the study area farthest from the exploration site; six of those had workers at the Pebble site during the study period. All are a part of the Bristol Bay region, or the Lake and Peninsula Borough, but they are significantly more than 100 miles from the Pebble site. There are more communities and people in this region than in the other two, but it had fewer residents working at the exploration site. The population of these communities was 4,589 in 2010 (Table 5). Over half the population lives in Dillingham, the regional hub for the west side of Bristol Bay. The other half is spread throughout the region. On average about 78% of regional residents are Alaska Native, but that percentage varies from slightly less than half in Egegik, to 97% in Perryville, Chignik Lake, and Twin Hills. Two thirds of Dillingham residents are Alaska Native.

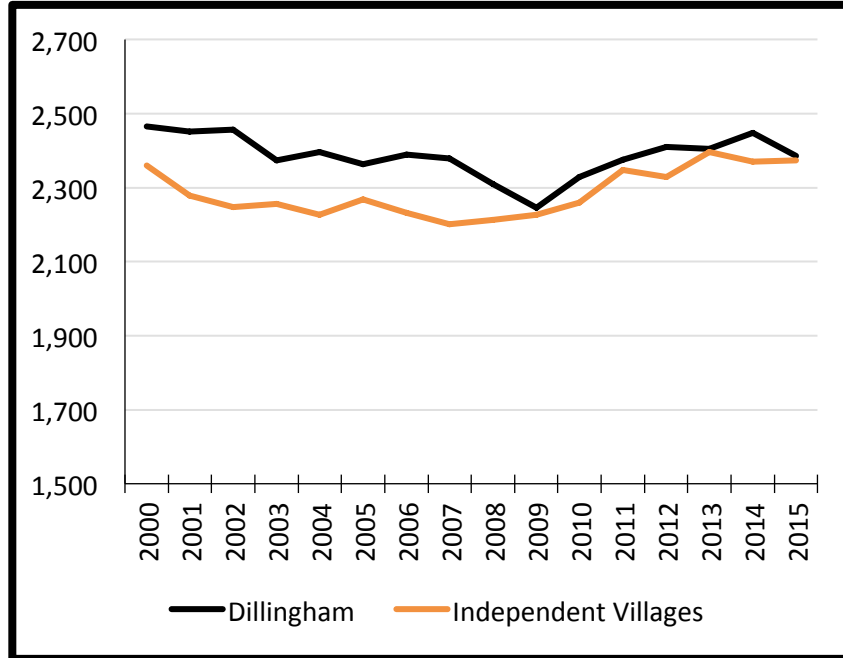
Table 5. Distant Region: 2010 Population and Percent Alaska Native
(Source: 2010 U.S. Census)

Distant Region	Population	% Native
Aleknagik city	219	85%
Chignik city	91	62%
Chignik Lagoon*	78	74%
Chignik Lake CDP	73	97%
Clark's Point city*	62	89%
Dillingham city	2329	67%
Egegik city*	109	47%
Manokotak city	442	96%
Perryville CDP*	113	97%
Pilot Point city*	68	84%
Port Heiden city*	102	85%
Togiak city	817	94%
Twin Hills CDP*	74	97%
Ugashik CDP*	12	75%
Total	4,589	78%

*Had no workers at Pebble exploration site

Like the Lakes and the Intermediate regions, this region also relies heavily on government and non-profit jobs, but the percentage is slightly higher, at 69%. The population of the region has remained roughly stable since 2000, though different villages have slightly different profiles. Figure 8 shows the recent trend for Dillingham—where half the population lives—and the other communities combined.

Figure 8. Distant Region: Population History
(Source: Alaska Department of Labor, ALARI Database)



Dillingham is the hub of the Bristol Bay commercial fishing industry. Residents of the Distant region fished 435 salmon permits during the study period—more than in the other study regions, but still down 40% since the 1980s (Table 6).

Table 6. Distant Region: Bristol Bay Commercial Salmon Permits Fished
(Source: State of Alaska, Commercial Fishing Entry Commission)

Distant Region	1980-1983	2009-2012
Aleknagik	45	19
Chignik City	13	6
Chignik Lagoon*	14	20
Chignik Lake	10	3
Clarks Point*	23	10
Dillingham	271	166
Egegik*	48	13
Manokotak	96	51
Perryville*	7	8
Pilot Point*	31	9
Port Heiden*	24	8
Togiak	130	117
Twin Hills*	9	4
Ugashik*	5	4
Total	725	435
		40% decrease

*Had no workers at Pebble exploration site.

C. Workforce Recruitment

Pebble Limited Partnership (PLP), which operated the exploration site, made an effort to hire locally. The CEO of Pebble was a long-time Alaska resident with experience developing shareholder hire agreements for the Native-owned Red Dog Mine near Kotzebue, and had a long history of work with Alaska Native issues and businesses. A preference for local and Alaska Native hire was transmitted from the top down from the CEO to others in the organization.⁵

The company had a local hire coordinator who worked in Iliamna and completed outreach to some of the other villages. The coordinator educated locals about job opportunities and helped them apply. Some villages also had a village-based stakeholder relations coordinator. The company reports getting more job applications from those villages due to this connection. The company also worked with the State of Alaska, which provided funding and assistance on a driller apprentice program. The state also provided support for training with contractors on other work, such as construction management. PLP worked with non-profit industry and educational organizations—such as the Alaska Process Industry Career Consortium, Alaska Resource Education, and the Alaska Miners Association—to educate and help qualify local residents for jobs. The company required contractors to work with it on local hire initiatives whenever possible, and it also contracted with local Native village corporations on the assumption that the corporations would give a preference to shareholder hire (local Native hire). The company also contracted with non-Native local businesses. Finally, the company encouraged specialized contractors from outside the region to hire locally when possible.⁶ Examples of these contractors would include drilling companies and wetland specialists.

By roughly the middle of the study period, the job opportunities were well enough known in the Bristol Bay region that the project had more local applicants than jobs.⁷

A variety of jobs were available at the exploration site. Some, such as bus driver, required a license but limited training. Others, such as expeditor or core cutter, could be filled through on-the-job training. Even specialized contractors—such as those taking water-quality samples or mapping wetlands—often had support positions appropriate for entry-level employees. Other jobs, such as driller or helicopter pilot, required significant experience and training, and still others, such as geologist, hydrologist, or anthropologist, required advanced degrees. Local residents occasionally filled jobs requiring advanced education and training.

Table 7 shows the 56 kinds of jobs held by the 300 residents of the Bristol Bay region who worked at the project site during the study period. The jobs listed are for people who worked for Pebble Limited Partnership or one of 20 contractors.

⁵ Personal communications with numerous staff of Pebble Limited Partnership.

⁶ Personal communication with Josie Hickel, former vice-president for Human Resources and Administration, Pebble Limited Partnership.

⁷ Personal communication with John Shively, CEO, Pebble Limited Partnership.

Table 7. Job Titles: Pebble Bristol Bay Site Employees, 2009 through 2012

(Source: PLP Exploration-Site Database)

Job Title	Number	Job Title	Number	Job Title	Number
Drill Helper	113	Laborer	7	Manager, Tech Ops	2
Bear Guard	73	Geological Assistant	6	Safety Coordinator	2
Skilled Laborer	59	Extern-Teacher	5	Staff Scientist	2
Kitchen Assistant	55	Drill Support	4	Administrative	1
Housekeeper	34	Helicopter Pilot	4	Bear Guard/Enviro Tech	1
Reclamation Tech	33	Contractor	3	Camp	1
Incinerator Technician	21	Coordinator	3	Camp Services Supervisor	1
Observer	17	LH Coordinator	3	Community Relations Liaison	1
Community Associate	16	Load Master	3	Core Yard Laborer	1
Technician	16	Carpenter	2	CP Cup	1
Van Driver	14	Consultant	2	Geotechnical Core Logger	1
Environmental Technician	12	Cook	2	Manager	1
Helicopter Coordinator	12	Cook Helper	2	Manager, PLP	1
Manager, Other	12	Electrician	2	Pilot, Fixed Wing	1
Core Sampler	9	Geophysical / Surveyor Tech	2	Regional Outreach Coord.	1
Administrative Assistant	8	Health & Safety Officer	2	Saw Shack Manager	1
Driller	7	Helicopter Mechanic	2	Surveyor	1
Environmental Consultant	7	Land Surveyor	2	Teacher Coordinator	1
Geotech	7	Local Hire Coordinator	2		

They include only jobs at the work site at any point. Not all jobs were filled each summer. Not all lasted all season. Workers may have held more than one job title during a summer or during the four-year period. Some of these employees worked for less than a year, some for all four years. The number does not include Bristol Bay employees who worked off-site (i.e., in Anchorage or elsewhere). These are a small number (approximately 4%), relative to the on-site employees.⁸

The table shows that the most common jobs were drill helper, bear guard, skilled laborer, and kitchen assistant. Note that the table does not mean there were 113 drill helpers employed at any one time; rather, it means that 113 workers held the title of drill helper during the four years.

Section II. Methodology

From 2009 through 2012, the exploration company, Pebble Limited Partnership, kept records of everyone who worked at the exploration site, irrespective of whether the worker was employed directly by PLP or by a contractor. Each time workers came to the site, they were required to sign in. For internal tracking, the company compiled this information into an annual database. The company supplied some of this exploration-site database to the authors, including employer (PLP, or the name of the contractor), job title, number of hours worked, home town and gender. The company supplied this annual information to the authors on a confidential basis, with the

⁸ PLP's site database records everyone who came to the site. Four percent of Bristol Bay employees who came to the site listed their employment center as Anchorage or elsewhere. There may be a few other Bristol Bay employees who never came to the site and are not included in the study.

understanding that they could publish grouped data—i.e., not data for specific individuals or companies.

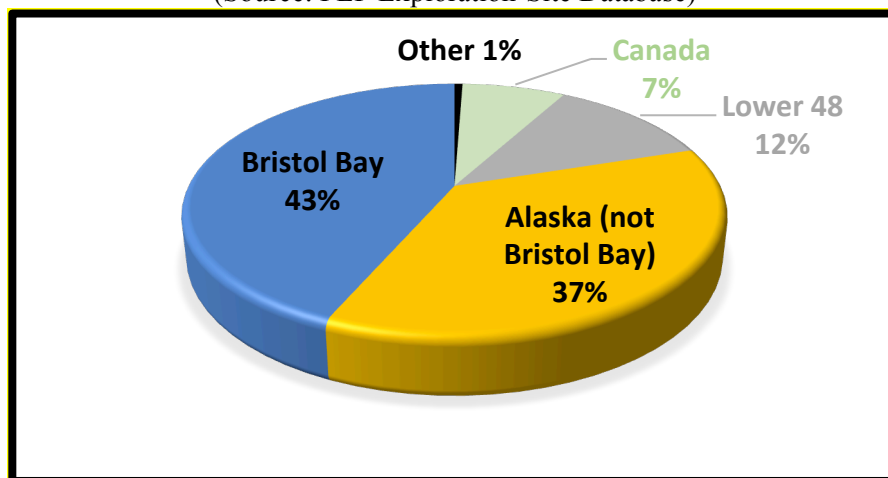
The database did not include salary information, but PLP supplied salary information for its own employees. For employees of contractors, the authors contacted the individual contractors for salary information. We initially called them, and then followed up with an e-mail or letter for each of the 20 contractors. The contractors were usually cooperative and frequently supplied salary data by employee, job title, or other identifier. If we still lacked salary information for some employees after that, we worked with PLP and state data to estimate the likely salary. The information from the PLP database, as augmented with salary information from the contractors and ISER estimates, is the basis for this report.

The information provided to the authors and analyzed in this report focuses on employees who came to the exploration site. Contractors who worked at the contractor's home office in Anchorage or elsewhere and did not come to the site would not be in the database. In addition, PLP employed Bristol Bay residents who did not come to the site, including some year-round employees. Therefore, the conclusions of this report apply to the site-related workforce, and may slightly underestimate the full employment and income effects on Bristol Bay communities.

Section III. Community Workforce at the Pebble Project, 2009-2012

Local Hire. From 2009-2012, the exploration project employed a total of 301 people whose employment information listed their home as a community in Bristol Bay. Figure 9 shows home locations of everyone who worked at the project site, including both those who worked directly for PLP and for one of 20 contractors.

Figure 9. Home Location of Pebble Exploration Site Employees, 2009-2012
(Source: PLP Exploration-Site Database)



The figure shows that approximately 80% of the workers at the project site were from Alaska: 43% from the Bristol Bay Region and 37% from elsewhere in the state. The remainder were almost all from other states or Canada; a very few were from outside the U.S. or Canada. (In this

report “employees” include anyone who worked at the site—whether they worked full-time, for the season, part-time, or just one day.)

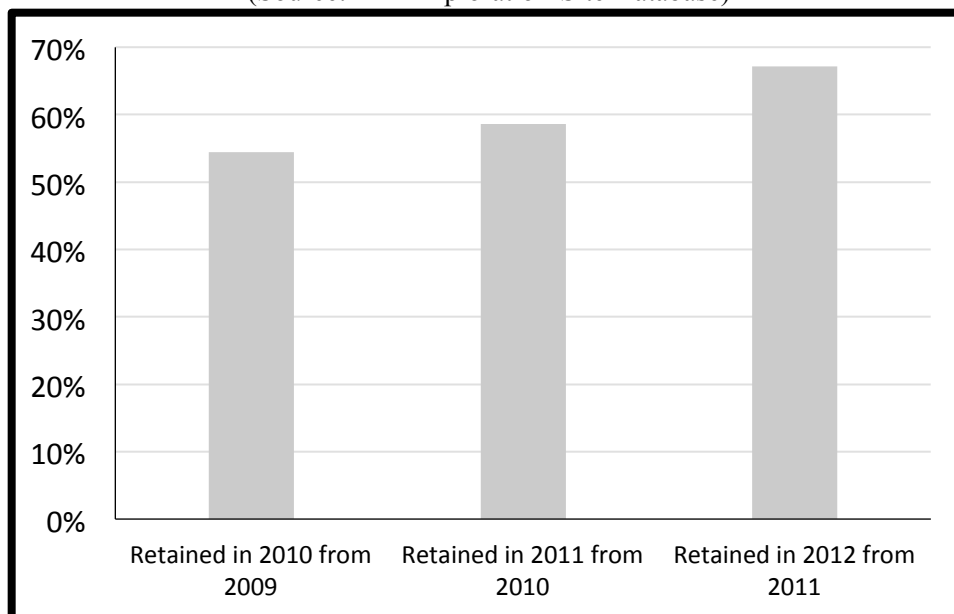
For an exploration project to hire 80% of its workers from the state, and 43% from local communities, is high by global standards. In some areas of the world mining ventures have had difficulty attracting a local workforce (Storey 2010; McPherson 2003) and incorporating an under-skilled local workforce (Storey & Hamilton 2003; Surat Mining Boom Offers Job Prospects 2007). In Nunavut, whose residents are primarily Inuit, the Nanisivik Mines Ltd. achieved only a 30% indigenous hiring rate, despite having a goal of 60% (McPherson 2003), and Meadowbank had only a 21% local hire rate (Bernauer 2011), far lower than what we found during any year of Pebble exploration. The Diavik mine company in the Northwest Territories campaigned to hire Northerners—the Canadian equivalent of Alaska residents—and indigenous peoples. After 11 years, it achieved 62% employment of Northerners and 30% of indigenous peoples (David 2011). Ekati diamond mine in the Northwest Territories, which has some of the highest local and indigenous employment rates, obtained 62% Northern employment and 50% indigenous. In Northwest Alaska, the Red Dog Mine is known for its high rates of employment of indigenous people (55-57% NANA shareholders, Haley and Fisher 2012; Loeffler 2015).

A mineral exploration project can have a harder time than an operating mine developing a local workforce, because it does not have the time to generate a training system for the mine, or to develop a workforce experienced with the project. For an operation in the exploration stage with an uncertain future, the hiring rates at Pebble exploration achieved appear quite high by standards of similar projects.

Retention. The multi-year data also show that many Pebble employees were willing to return to their jobs year after year. The authors calculated retention rates by identifying employees from one year who returned the next year. As Figure 10 shows, over half the employees in 2009 came back the next year, and that retention rate increased over the four years of the study period. Between 2011 and 2012, over two-thirds of the Bristol Bay area employees returned. By comparison, retention rates for the Red Dog mine, which has a high retention rate compared with similar projects, has rates between 60% and 80% (Haley and Fisher 2012).

Figure 10. Retention Rates for Bristol Bay Employees at the Pebble Exploration Site, 2009-2012.

(Source: PLP Exploration-Site Database)



In addition, about 30% of employees who stayed two or more years received significant raises, and about one-third of those who stayed two or more years also changed jobs. Sometimes the job changes were in the same line of work, such as from a drill helper to a driller (a promotion), or from a kitchen assistant to a cook. Many times, the job changes were to an unrelated skill, such as a skilled laborer to a bear guard, a housekeeper to an incinerator technician. Sometimes the change in job title was associated with an increase in pay, sometimes not.

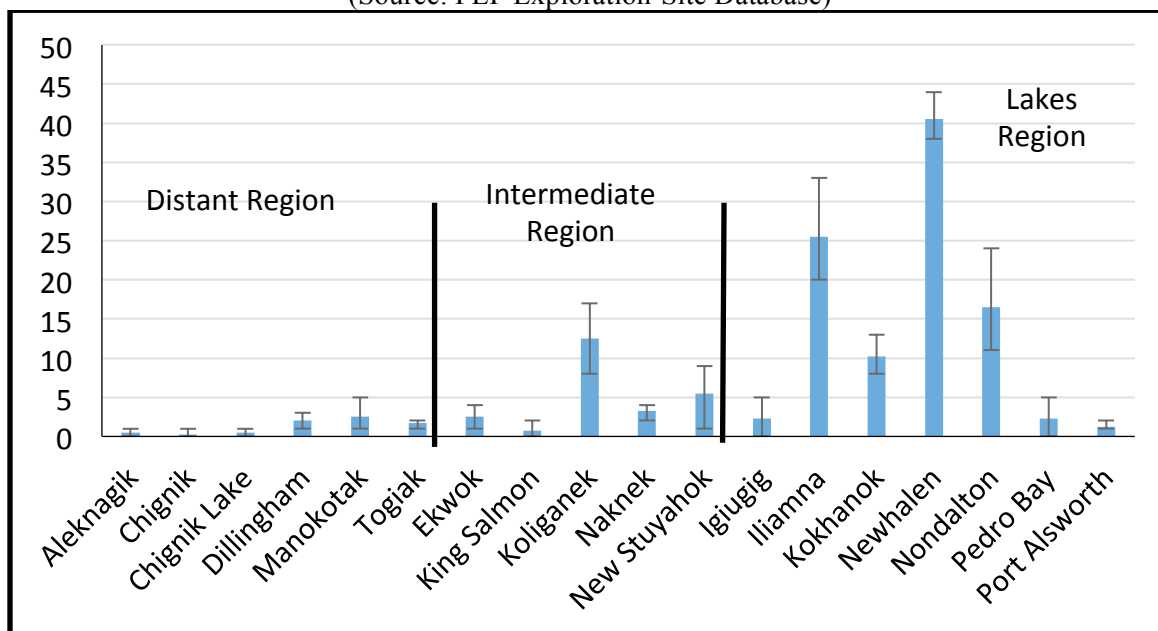
From 2009-2012, the average hourly wage for Bristol Bay residents working at the exploration site was \$19.15/hour (median pay \$17.50/hour).

Section IV. Community Effects

Employment. In 2009, there were 103 people from Bristol Bay communities employed at the Pebble exploration site. The number grew each year—126 in 2010 and 128 in 2011—and in the final full year of exploration, 2012, the project employed 164 people from Bristol Bay. Figure 11 shows the job distribution by community.

Figure 11. Average Annual Employees by Community, 2009-2012

(Source: PLP Exploration-Site Database)

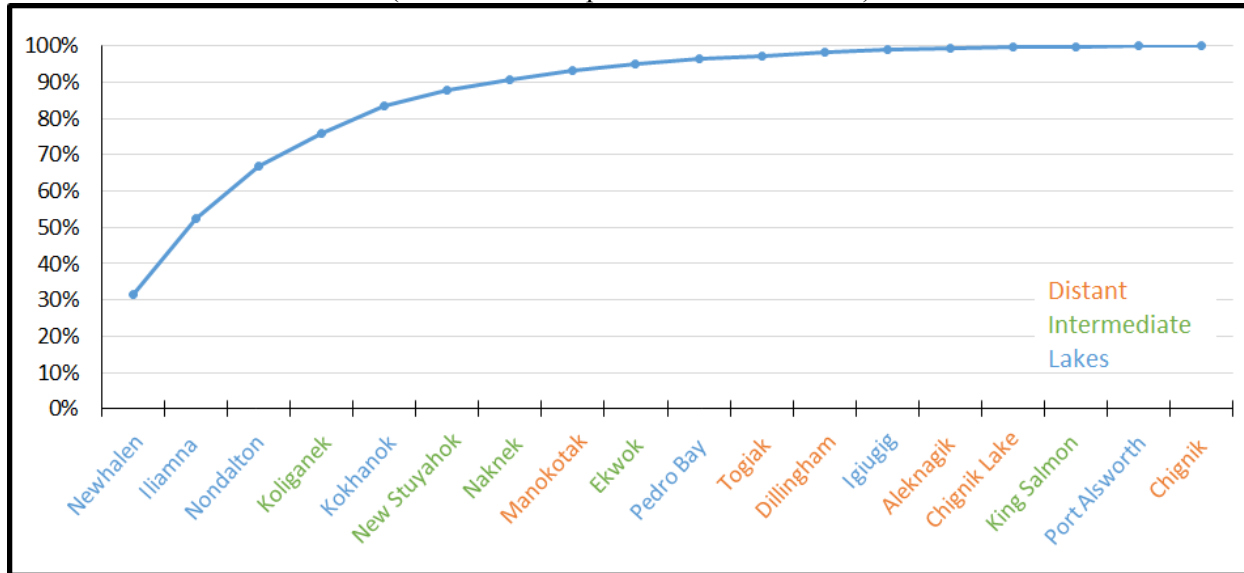


The thicker bars in the figure show the average annual number of employees from each community over the four years from 2009-2012. The thinner “I”-shaped bars show the highest and lowest employment during those four years. For example, Newhalen, which had the most project employees during the study period, had a low of 38 employees in 2009 and 2010 and a high of 44 employees in 2011. Newhalen’s average annual employment over the four years was 40.5.

The figure shows that employment varied significantly from place to place, but that just a few communities captured most of the project jobs. Figure 12 shows that more directly.

Figure 12. Cumulative Employment Hours by Community, 2009-2012

(Source: PLP Exploration-Site Database)



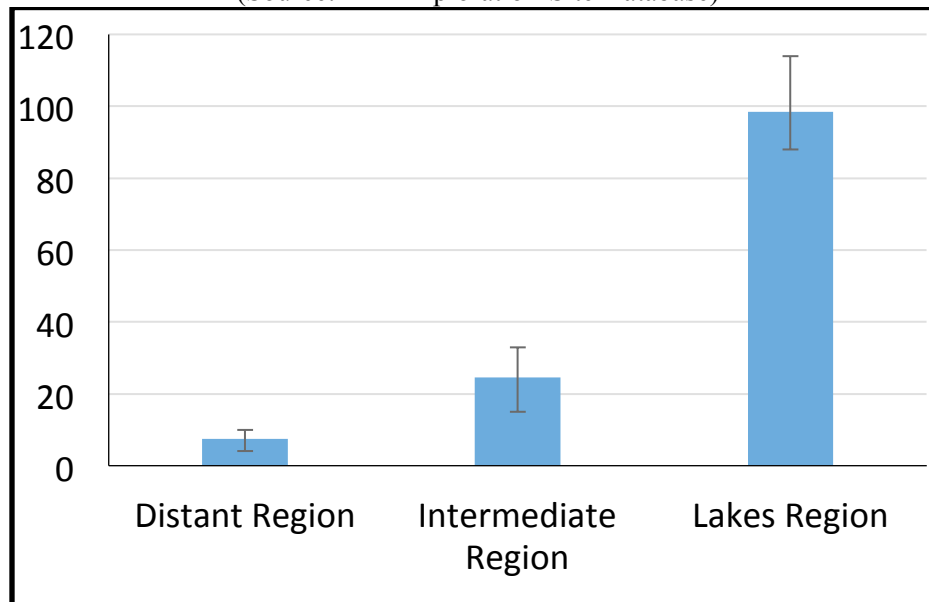
Based on the cumulative hours Bristol Bay employees worked at the project from 2009 through 2012, Figure 12 shows the cumulative percentage of hours worked, beginning with Newhalen, which had the most employment hours. The figure shows that a few villages contributed the clear majority of employees: 84% of the hours worked during the study period were by workers from just five communities: Newhalen, Iliamna, Nondalton, Koliganek, and Kokhanok.

It looks as if a major determinant of the number of local residents working at the project site was proximity: the closer the community, the more workers. That may be due, in part, to transportation logistics. The easier it was for workers to reliably get to the project site, the more likely they were to apply. Employees were housed on-site, so a daily commute was not a factor, but PLP managers told us that ease of getting to the site was important. Other reasons why some communities had more residents interested in working at the project might be in part random, in part due to other economic opportunities unique to a community, and in part due to the community's attitude about the exploration project. Still, the major factor influencing the number of workers from a community appears to be how close the community was to the site.

In general, figures 11 and 12 show that employment at the project dropped off sharply with distance from the project. This relationship is clearer when we aggregate the results by region, as Figure 13 does: it shows that the region closest to the project had by far more people employed at the site.

Figure 13. Average Annual Employees by Region, 2009-2012

(Source: PLP Exploration-Site Database)



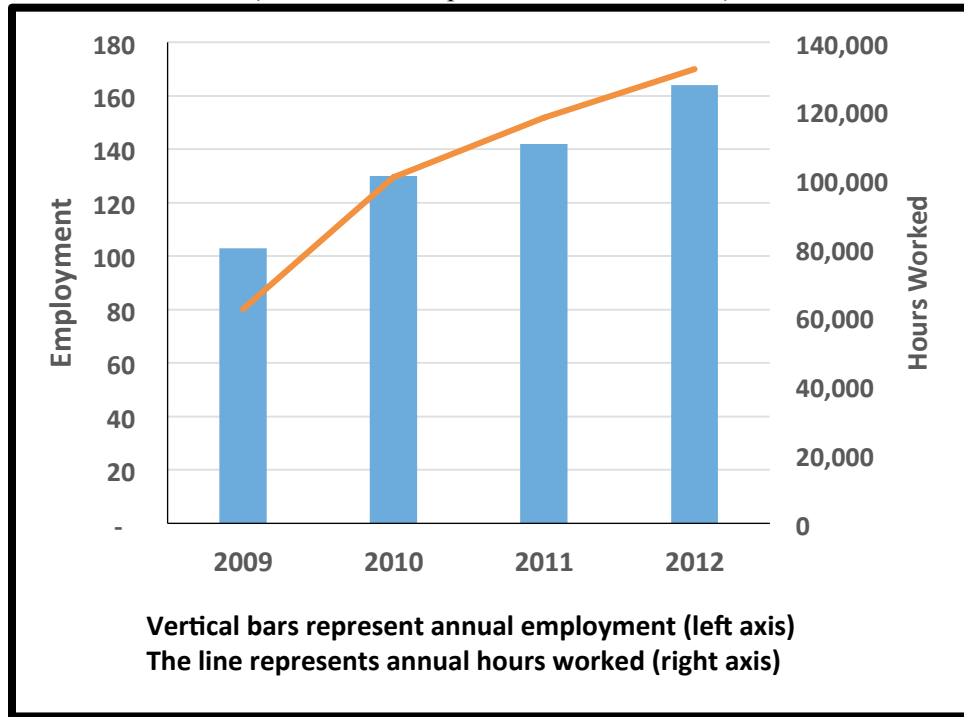
In the Lakes Region, for the four years of this study, the project employed almost 100 people per year. Employment from the region began at 88 in 2009 and climbed to 114 by 2012. The average was 98.5. However, that level of employment was not duplicated in other regions. Regions further away had much less employment and income from the project. The Lakes region had four times the average annual employment as the Intermediate region (24.5), and more than 13 times the average employment as the Distant region (8).

Comparing project employment with that of other seasonal jobs, the 100 people the project employed from the Lakes region was significantly greater than the 39 commercial salmon fishing permits fished by people from the region during the study period. (Note that total commercial salmon fishing jobs would be more than 39, because crew members are not included in this comparison). But in the other two study regions, commercial salmon fishing employed many more people. There were 173 resident commercial salmon fishing permit-holders in the Intermediate region, which is more than seven times the number of people the exploration project employed. In the Distant region, the difference was even larger, with 435 resident commercial fishing permit-holders.

Figure 14 totals annual employment and hours worked by Bristol Bay residents from all three study regions. The number of project employees from Bristol Bay increased every year, as did the total hours worked they worked. The number employed climbed from 103 in 2009 to 164 in 2012. The number of hours worked increased similarly. For the Lakes region, where most of the employees came from, this was a significant percent of the workforce. Average employment over the 4 years is approximately equal to 14% of the total workforce in that region. It is much less for other regions: 3% for the Intermediate region and close to 0% for the Distant region.⁹

⁹ This is an order of magnitude comparison because the size of each region's workforce is taken from the 2012 5-year average from the American Community Survey. Therefore, it is comparing an average 2009-2012 Pebble employment with an average 2008-2012 workforce from each region.

Figure 14. Annual Employment and Hours Worked by Bristol Bay Residents, 2009-2012
(Source: PLP Exploration-Site Database)



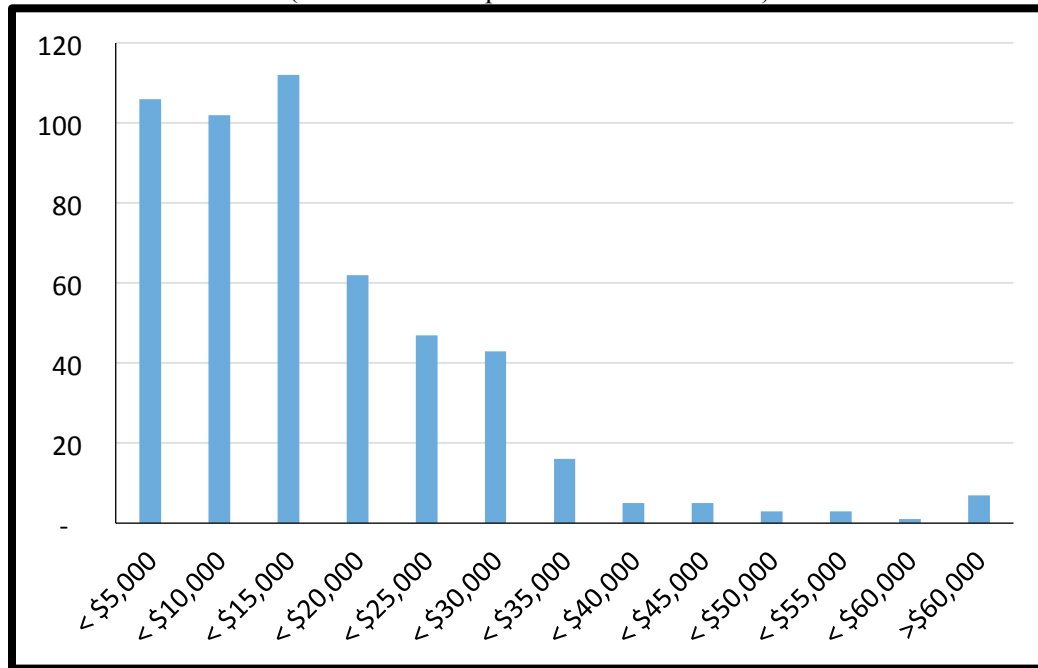
The authors reviewed data from the Alaska Department of Labor, to see if there was an increase in total private earnings in the study region during 2009-2012. The data do not show an increase in total private wages proportional to the total increase in hours worked—though they do show some increase, then a decrease after 2012. It's likely the exploration project caused some significant increase in total private hours wages, but not as much as we might expect—because some people who worked at Pebble probably choose to work at Pebble rather than at other jobs.

Individual Income. The average annual income of Bristol Bay residents who worked at the Pebble site during the study period was \$15,415 (median = \$11,822). That amount is roughly one-third of the 2011 mean earnings¹⁰ in the Lake and Peninsula Borough, reported by the U.S. Census Bureau. The distribution of individual earnings from the four years is shown in Figure 15.

¹⁰ Mean earnings is significantly less than mean annual income because earnings exclude income from investment, transfer payments, and similar non-earned income.

**Figure 15. Distribution of Annual Earnings of Bristol Bay Residents
From the Pebble Exploration Project, 2009-2012**

(Source: PLP Exploration-Site Database)

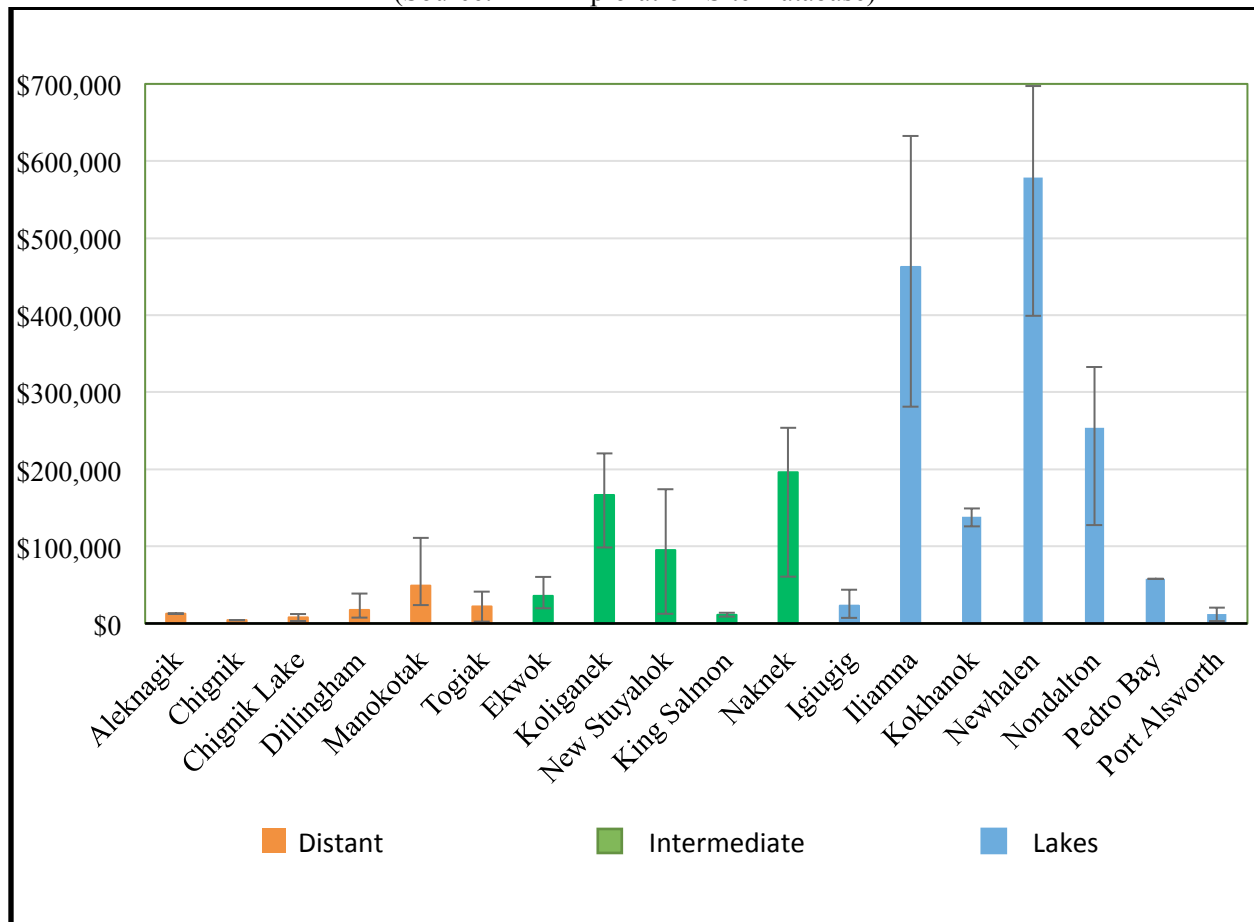


The figure shows the number of people who earned amounts in each income category. The first bar shows that 106 people earned less than \$5,000 per year. The second bar shows the number who earned between \$5,000 and \$10,000 per year, and so on. The final bar on the right shows that seven Bristol Bay residents earned more than \$60,000 at the project annually. These were likely among the few site employees who worked year-round rather than just during the summer.

While the information above shows the importance of the employment income to individual workers, the next section discusses the effects of employment income on the community level.

Community Income. While income is important for the individuals who earn it, of course, it is also important for their communities. Figure 16 shows the annual income communities earned from the Pebble project, on average from 2009-2012. It is the income from each of the individual workers from the community, added up for each year. The thicker bars show the average annual income. The “I”-shaped bars show the highest and lowest income for the four-year period.

Figure 16. Average Annual Community Income from Pebble, 2009-2012
 (The bars represent the maximum and minimum village income during the four years)
 (Source: PLP Exploration-Site Database)

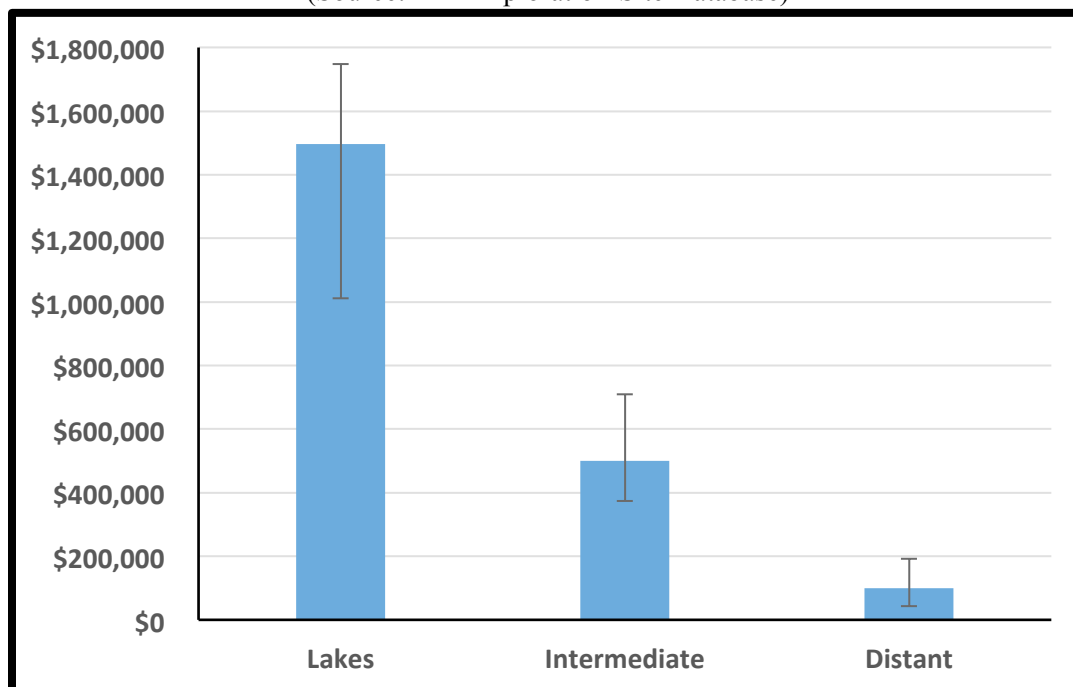


Income from the exploration project was an important part of the income in most, but not all, of the Lakes region communities. For example, the income for Newhalen, the community with the most workers, averaged \$583,000 per year and ranged from \$415,000 in 2009 to \$697,000 in 2011. However, Igiugig, Pedro Bay, and Port Alsworth had much less income from the project, at a level comparable to that of communities farther away. Income from the project was significant for some communities in the Intermediate region, but the project brought relatively little money into communities in the Distant region.

Figure 17 shows the same information, but aggregated by region. The Lakes region captured much more income from the project than the regions further away—on average nearly \$1.5 million during the study period, compared with about \$500,000 in the Intermediate region and \$100,000 in the Distant. The “I” bars show the annual variation in income for each region; the upper end of the bars were all in 2012, when all three regions had the highest annual income.

Figure 17. Average Annual Regional Income from Pebble, 2009-2012

(Source: PLP Exploration-Site Database)



Comparison with other income sources. To understand the significance of project income to Bristol Bay communities, it is useful to compare it with income from other sources: commercial salmon fishing, which is the major industry in the Bristol Bay area, and Permanent Fund dividends, which the state government pays annually to all Alaska residents.

The PF dividend averaged \$1,149.50 annually during the study period.¹¹ We assumed 94% of residents received a dividend (McDowell, 2008). The authors estimated salmon fishing income from Alaska Commercial Fisheries Entry Commission information, and with information and methodology from previous ISER reports (Knapp et al. 2013). Commercial fishing income included estimated income for crew members and permit holders.

Figure 18 compares total income the study regions received from these three sources from 2009 through 2012. Revenue from commercial fishing includes only that from the Bristol Bay salmon fishery. (Total commercial fishing income, including that from cod, Pollack, and other fisheries, and income from fisheries beyond the region, would be more.) Appendix A describes how Figure 18 is calculated.

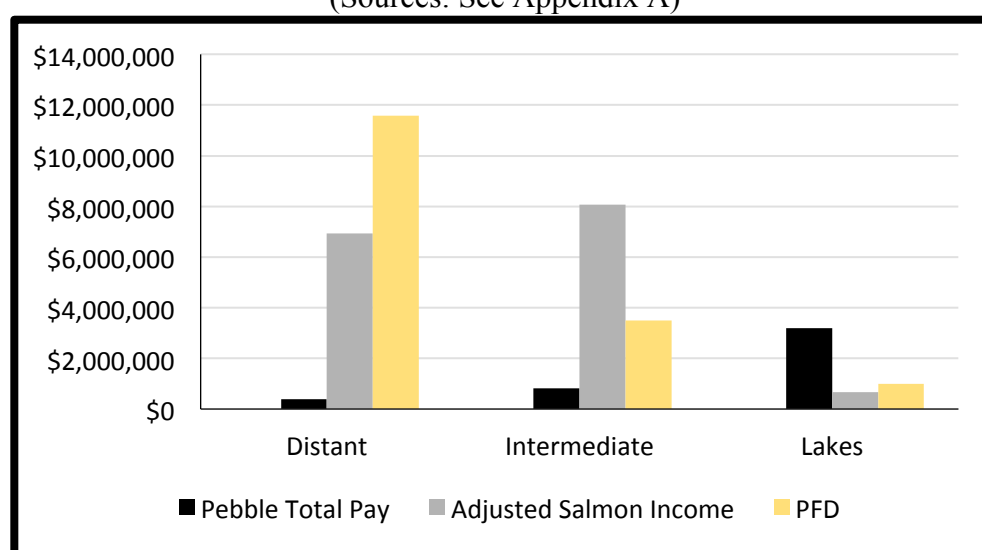
The calculations are based on fishing income by permit holder—that is, the figure is calculated from the fishing earnings (minus estimated cost) associated with salmon permit-holders living in Bristol Bay. Because those earnings include income for the permit-holders and their crews, the calculation implicitly assumes that crew members live in the same region as the permit holder. That assumption is not strictly correct, because we know people from one region may fish with

¹¹ 2009: \$1,305; 2010: \$1,281; 2011: \$1,174; and 2012: \$878. Source Alaska Permanent Fund Corporation, www.apfc.org/home/Content/dividend/dividendamts.cfm

permit holders from elsewhere. Therefore, the figure should not be interpreted strictly. Rather, it is an order-of-magnitude comparison between commercial salmon fishing income, PF dividend income, and income from the Pebble project.

The figure shows that in the Lakes region—the region closest to the exploration site—the income from Pebble was much greater than that from either commercial fishing or the PF dividend during the study period. In the other two regions, which have larger populations and are further from the project, income from the Pebble project was a small percentage of the income from either commercial salmon fishing or the PF dividend.¹²

Figure 18. Comparison of Regional Income from Commercial Salmon Fishing, Permanent Fund Dividends, and the Pebble Exploration Project. (Total income, 2009-2012)
(Sources: See Appendix A)



The difference between regions is not surprising, because it is consistent with the number of Pebble jobs held by residents of the study regions (greatest in the Lakes Region), and the amount of Pebble income by region.

For the Lakes region, the authors also compared income from Pebble with other measures of total village income: specifically, with total household income and earned income. For the Lakes region, the annual total of earned income in the seven villages was \$13.2 million. Annual household income, which includes income from investments and transfers was \$16.2 million.¹³

¹² This figure only compares Pebble total pay, adjusted salmon income, and PF dividends for communities that had employees working at the Pebble exploration site. Some communities in the Distant and Intermediate Regions had no employees at the site. If income of those communities had been included, it would make Pebble's comparative regional income smaller in these two regions. It would not have changed the comparison in the Lakes Region, because all communities had employees who worked at the site.

¹³ Earned income and household income is taken from the 2012 American Community Survey, Table DP03. The margin of error, at a 90% confidence interval, is 12% of household income and 17% of earned income. The 2012 ACS survey is a 5-year moving average value. It averages samples taken from 2008-2012 (adjusted for inflation to 2012 dollars). Therefore, the comparison is not exact but shows the general magnitude of Pebble's income contribution to the Lakes Region.

Income from Pebble averaged 6% of earned income in the region (and 5% of total household income). However, income from the Pebble project varied considerably by year. In 2009, income was only 3% of earned income but had grown to 9% by 2012. (Of household income, it grew from 3% to 7%).

The Aftermath. After the exploration project ended in 2013, almost all site-related work and local employment stopped as well. Income from the project therefore stopped as well. Unfortunately, available government statistics are not perfectly suited to measuring how the end of exploration affected income in the Bristol Bay region.¹⁴ Alaska Department of Labor (DOL) information on total wages in the region is the best indicator of the effect. DOL data show that every village in the Lakes region has seen a decline in total wages, except Port Alsworth—which has seen a significant increase. Specifically, DOL data indicates that total wages in the Lakes region fell 13% between the high point of 2012 and 2015 (the most recent data). Excluding Port Alsworth, wages in the Lakes region declined by 20%.

The significant increase in wages in Port Alsworth is interesting, but mostly unrelated to Pebble. The regional air carrier, PenAir based out of Anchorage, stopped flying to the smaller Bristol Bay communities around 2010. An air taxi operator based out of Port Alsworth has captured much of the community-related travel PenAir previously had for the east side of Bristol Bay. This increase, along with unrelated expansion of employment in Port Alsworth, are responsible for the increase in that village's wages reflected in the DOL data. The Pebble-related traffic and the general increase in local travel due to larger community income was helpful, though not crucial, to funding some of the initial increased capacity to replace PenAir's services. The increase shows that a single business can have a significant effect on a small community, though the effect would be lost in a larger community like Anchorage or even Dillingham.

¹⁴ The American Community Survey, published by the U.S. Census only published a five-year moving average for communities in the region. At this writing, the most recent five-year average is 2014, which has too great an overlap with the study period to be useful. Alaska Department of Labor statistics are more useful, but they too have drawbacks. The Department of Labor earnings do not include self-employment figures (which likely excludes most commercial fishing income) and is missing earnings from federal government employment. Nevertheless, the DOL data provide an indication of the change in income.

Appendix. A. Calculation of Income from Commercial Salmon Fishing and from the Alaska Permanent Fund Dividend.

Income from the permanent fund dividend (PFD) was calculated using annual village population from the Alaska Department of Labor and Workforce Development (Alaska Local and Regional Information, ALARI, database), and the permanent fund dividend amounts.¹⁵ The village population estimate was adjusted assuming 94% of those individuals received a dividend (McDowell 2008). Then the adjusted community population size for that year multiplied by that year's PDF amount provides the permanent fund dividend income to the village.

Commercial fishing income was obtained from the Alaska Commercial Fisheries Entry Commission (CFEC; (<https://www.cfec.state.ak.us/>)). The State of Alaska maintains this database which contains information on the number of permits, total pounds landed, and gross earnings. We only looked at salmon fishing permits, since this is the primary species harvested in the region and used CFEC's gross estimated income by permit. There are different salmon fishing groups (i.e. codes) each of which require permit holders to report back their salmon fishing activities. Fishing data is reported for individual groups and as a total. For confidentiality reasons, fished landings and income are masked (i.e. not reported) for groups in which less than four, but greater than zero, permits were fished. However, the number of permits fished is still reported. If a community has multiple groups and one of these groups meets the requirements to be masked, then the second smallest group is also masked to prevent back calculation. We used the annual estimated gross income from all salmon fishing for a community when available. For communities with years when data was masked we calculated the gross income by using the average estimated gross earnings specific to that fishery group, year, and management area. There are three management areas within our study region, Bristol Bay, Dillingham, and Lake and Peninsula. For example, if Ekwok, which is in the Dillingham area, had a total of three salmon permits in 2010 we used the average estimated gross earnings for that year from other communities within the Dillingham area and multiplied that by three to get the estimated total gross earnings.

Gross earnings do not consider the cost of fishing which was found to be \$31,069/permit Knapp et al. (2013). That number does not include the cost of payments to crew members. Regional income from commercial salmon fishing is calculated as the total gross earnings from salmon permits attributed to villages within each region (according to CFEC data), minus the cost of fishing noted above. This calculation implicitly assumes that crew members live in the same region as the permit holder. This is not strictly true. Some crew members likely live elsewhere. Therefore, the regional calculation of fishing income should be taken as order-of-magnitude only. They are likely accurate enough to show the approximate relative importance of the regional commercial salmon fishing income relative to regional income from Pebble Exploration Project, as shown in Figure 18.

¹⁵ 2009: \$1,305; 2010: \$1,281; 2011: \$1,174; and 2012: \$878. Source Alaska Permanent Fund Corporation, www.apfc.org/home/Content/dividend/dividendamts.cfm

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